IES
Newsletter

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Director's Note

The members of the Mary Flagler Cary Arboretum provide important support for the research and education programs of the Institute of Ecosystem Studies. At present we have 442 members, primarily in Dutchess County, New York but also from other parts of the Northeast and more distant states. Their generosity is rewarded by the knowledge that they are contributing to efforts to promote an understandnig about natural ecosystems and the ethical utilization of natural resources by humans. Other membership benefits are described on page 4.

Periodically we encourage the enrollment of new members, and are about to embark on such a campaign. Prospective members are being sent a letter describing the Institute's programs and achievements as well as a copy of this issue of our newsletter. Here, we introduce a new focus of research at the Institute, that of soil ecology; update some of our ongoing education efforts, the Eco-Inquiry curriculum for 5th and 6th grades and the Continuing Education Program for adult students; and list upcoming events. We look forward to sharing our programs and progress with renewing and new members alike.

The IES Newsletter is published by the Institute of Ecosystem Studies at the Mary Flagler Cary Arboretum. Located in Millbrook, New York, the Institute is a division of The New York Botanical Garden. All newsletter correspondence should be addressed to the Editor.

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Eco-Inquiry: Nation-wide Dissemination Begins

Just over a year after receiving a National Science Foundation grant in support of the expansion and dissemination of Eco-Inquiry, Institute educators report that the nation-wide dissemination process has begun. This major step comes after six years of planning, writing and fine-tuning the semester-long curriculum, of organizing teacher workshops and pilot programs in each of the Dutchess County (New York) school districts, and of coordinating a fall 1991 pilot program in New York City to evaluate the suitability of the curriculum for urban school systems.

Eco-Inquiry, developed by IES educational research and development specialist Kathleen Hogan, is a school science program that teaches 5th and 6th grade students how an ecosystem works, who scientists are, and why and how they do what they do. Its innovative combination of classroom experiments such as measurement of the effects of 'compost tea' on the growth of radish plants, outdoor ecology adventures, original stories, ecosystem games, role-playing ("dress the scientist") and tape-recorded "Mysteries in Ecosystem Science Activities" (MESAs) makes science fun while providing carefully sequenced educational experiences that reinforce learning. Students also develop inquiry skills -- skills that not only help them understand the way that the natural world works but also teach them how to think creatively to tackle challenges in all aspects of their lives.

For three days in mid-February, the newly-formed Eco-Inquiry National Dissemination Team met at the Institute. Comprising one science center staff educator and one local teacher selected by administrators of the Desert Botanical Garden in Arizona, the Fernbank Science Center in Georgia, the Cranbrook Institute of Science in Michigan, the Missouri Botanical Garden and the Oregon Museum of Science and Industry, each team was introduced to the techniques and materials for teaching Eco-Inquiry. Ms. Hogan, Eco-Inquiry project coordinator Lisa Morganstern and IES head of education Dr. Alan Berkowitz worked with the ten team members, presenting an overview

continued on page 3

JILL CADWALLADER

Eco-Inquiry project coordinator Lisa Morganstern, right, and Oregon team member Joyce Harris do a nature inventory at the hemlock forest along the Arboretum's Wappinger Creek Trail. Ms. Harris, director of Portland, Oregon's Black Educational Center, will train teachers in the Portland area.

Microorganisms in the Ecosystem

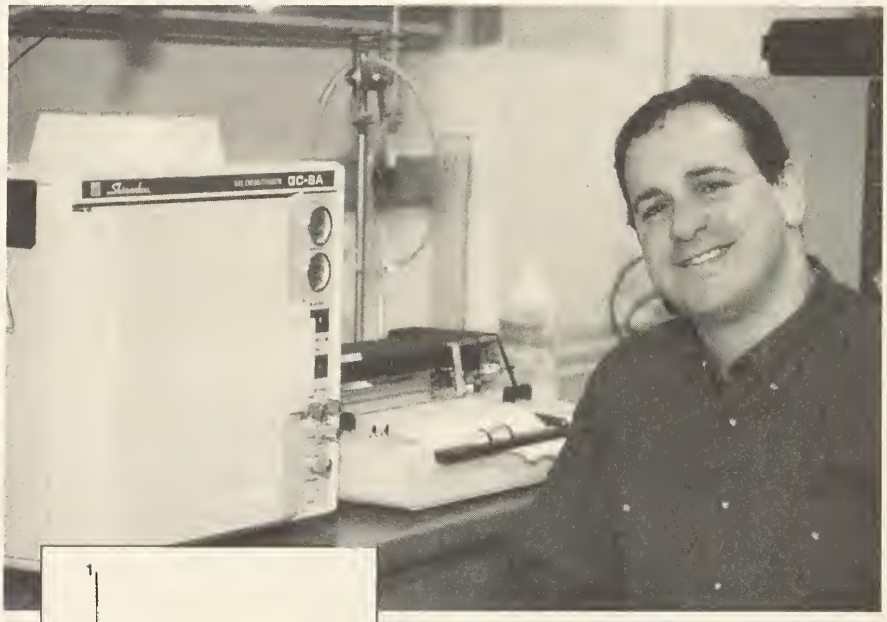
We don't see soil move on its own. We don't see it grow, or eat, or die. Does that mean that soil is a non-living component of an ecosystem? Soil has a non-living component, of course, which is the minerals and rock particles that comprise its matrix. However, consider this: in one gram of topsoil -- a mass even smaller than a cube of sugar -- there are a *billion* bacteria, and, in that same tiny sample of soil, there are five meters (over 16 feet) of fungal mycelia*. Thus, because soil includes a living community interacting with its non-living environment, it is an ecosystem in its own right and at the same time has a critical function in the larger, global ecosystem.

"Recycling" is a word that has become commonplace just recently, but soil has been a recycling center for nutrients since life on Earth began. The nutrients in an ecosystem are those naturally-occurring elements that are required by all living organisms; among these elements are oxygen, nitrogen, carbon, hydrogen, iron, phosphorus and sulfur. Thanks to the processes collectively called nutrient cycling, the pool of these elements constantly is being renewed.

Soil microorganisms degrade plant litter and other dead organic matter and release the nutrients contained within it. These nutrients then are cycled back into new plant growth. When nutrient cycles are disturbed by forest cutting, fertilization or other perturbations, ecosystems can lose large amounts of their nutrient "capital" with negative consequences for those ecosystems as well as for the surrounding environments. Soil microorganisms also degrade a variety of agricultural and industrial chemicals and produce "trace gases" that influence the chemistry and physics of the atmosphere (e.g., the greenhouse effect).

Because soils are fundamental to living systems, a knowledge of soil processes is important in order to understand fully the functioning of ecosystems. Funding from the Andrew W. Mellon Foundation made it possible for the Institute to hire an ecologist to study microbial processes in the soil, and Dr. Peter M. Groffman joined the scientific staff in January.

Dr. Groffman received his Ph.D. degree in ecology from the University of Georgia, where his research was on nitrogen cycling in agricultural soils. From 1984-1987 he had a post-doctoral position at Michigan State University, again studying nitrogen cycling but this time concentrating on how the biological processes occurring in the soil affect the chemistry and physics of the atmosphere through the production of trace gases. For the past four years he has been teaching about soils and microbial ecology and doing research on biosphere/atmosphere interactions and terrestrial/aquatic interactions at the University of Rhode Island.



Dr. Groffman uses a gas chromatograph to analyze air samples for trace gases produced by soil microorganisms.
Inset: This chromatogram shows peaks that indicate the presence and quantity of trace gases including methane (peak #4) and carbon dioxide (peak #5). These are important "greenhouse effect" gases, and soil microorganisms play a major role in their global budget.

At the Institute, Dr. Groffman will investigate three major ways in which microbial ecology is important to an ecosystem perspective. He will look at nitrogen cycling, and degradation of organic matter by soil microorganisms. He will study how water quality is affected by microorganism-mediated processes that result in the transformation of pollutants to harmless compounds. And he will continue his investigations of biosphere/atmosphere interactions. His work will be done in Arboretum forests and wetlands as well as at other sites in the Northeast.

Dr. Groffman also is studying nitrogen cycling in wetlands in Rhode Island, Massachusetts and Connecticut. Why are wetlands important? In addition to being nurseries for wildlife they clean up nitrogen pollution, so Dr. Groffman will investigate the important process of denitrification in these sites. There is a lack of oxygen in the sediments of wetlands (and in any soils or sediments that are wet for extended periods). The bacteria that live in these soaked sediments are anaerobic -- they can live in the absence of oxygen, using nitrate (a by-product of nitrogen cycling) instead. Nitrate in sewage and agricultural run-off is considered a pollutant due to its potential to create nutrient imbalances that can be detrimental to pond, lake and coastal ecosystems (see *Humans, Nitrogen and Rivers*, in the July - August 1991 issue of the newsletter). Anaerobic bacteria in wetlands remove nitrate from the ecosystem, converting it to harmless nitrogen gas that is released to the atmosphere.

Applications of Dr. Groffman's work will lead to a greater understanding of plant communities, of energy pathways in the soil ecosystem, of processes in heavily managed systems such as lawns, of factors affecting water quality, and of the flow and transformation of pollutants. His work also will help to clarify connections between terrestrial and aquatic ecosystems and between the biosphere and the atmosphere, thereby expanding our knowledge of the global ecosystem.

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* *Mycelia are the mass of threadlike filaments, or hyphae, that are the means for asexual reproduction by some species of fungi.*

Honorary BES Membership for Dr. Likens

IES director Dr. Gene E. Likens has been elected to honorary membership in The British Ecological Society "in recognition of his distinguished contribution to the science of ecology." In his address at December's General Meeting of the society in Exeter, England, 1990-91 president Dr. Peter J. Grubb cited Dr. Likens' achievements, among them his classic ecosystem studies at Hubbard Brook, New Hampshire, his documentation of the deposition of sulfuric and nitric acids in the northeastern United States, and his interest in improving the education of the public in ecology.

The British Ecological Society (BES) is the oldest and one of the most prestigious ecological societies in the world, founded in 1913 to advance the education of the public, to support ecological research and to disseminate the results of that research. Honorary members are those recognized by the BES Council as having rendered outstanding service to the subject of ecology and subsequently elected at the General Meeting. Also elected to honorary membership in December was Dr. Margaret B. Davis, a paleoecologist at the University of Minnesota at Minneapolis and a long-time colleague of Dr. Likens. Drs. Likens and Davis join 22 other honorary members of The British Ecological Society, three of them from the United States.

Continuing Education Program Update

The start of the new year brought the beginnings of a new direction for the Institute's Continuing Education Program. Responsible for developing and expanding the program is William S. Montgomery, who joined the Institute in January as program leader for continuing education.

For over 10 years, the IES Continuing Education Program has been offering courses leading to certificates in landscape design and gardening as well as classes in ecology, botany and natural science illustration, special workshops and ecological excursions. During the 1990-91 academic year, approximately 650 students from the Hudson Valley region, western Connecticut, southwestern Massachusetts and elsewhere participated in the program for reasons of professional advancement, personal development or, quite simply, educational enjoyment. Now, Mr. Montgomery plans to enrich the program with new certificate offerings and a stronger ecological emphasis. He will begin by focusing on ecological management, expanding IES programs in this field and developing stronger contacts with leading arboreta and environmental organizations. He hopes, too, to attract more students from the Albany, New York City, central Connecticut and northern New Jersey areas, all of which are within a two-hour drive of the Institute.

Mr. Montgomery, a resident of Danbury, Conn., has an MBA degree in management from the University of Pittsburgh and worked at AT & T for more than 22 years. With a long-standing interest in ecology and landscape architecture, he had the opportunity to change careers and to earn his master's degree in landscape design from the Conway School of Landscape Design in Massachusetts. While providing free-lance land planning and landscape design services in the Danbury area, he learned of the job opening at the Institute.

Mr. Montgomery and continuing education program assistant Jennifer Claiborne (below) have prepared a spring semester schedule that is being sent to over 4800 past and present students, IES members, and landscape and gardening professionals. Mr. Montgomery is in the IES Education Program office three days a week. He invites current and prospective students to call him at (914) 677-5359 if they have questions about planning a certificate program or about any other aspects of continuing education opportunities at the Institute.

TOM TAFT

Eco-Inquiry, *from page 1*

of the curriculum, leading nature inventories of three different habitats at the Arboretum and developing ways for the five science centers to incorporate Eco-Inquiry into school systems in their regions.

Back home, the newly-oriented dissemination teams now are selecting schools that will participate in the first stages of the dissemination process and introducing Eco-Inquiry's concepts and goals to local teachers and administrators. Some team members will be teaching the curriculum themselves during the spring term and will suggest revisions to the curriculum based on their experiences. In summer and fall 1993, Institute educators will travel to the five science centers to help team members lead workshops for teachers from participating schools. In the meantime, each science center will be preparing local ecology guides as supplements to the curriculum, in order to provide regional natural history information necessary for the outdoor activities.

Currently, Ms. Hogan and Ms. Morganstern are teaching Eco-Inquiry to a 5th grade class at Alden Place Elementary School in Millbrook. Their first-hand experiences and observations will be helpful as Ms. Hogan prepares the curriculum for publication later this year or early in 1993. Also, by means of *The Eco-Inquirer*, a newsletter edited by Ms. Morganstern, they are keeping in touch with the approximately 50 teachers in Dutchess County, the Bronx and Manhattan who were the first to use Eco-Inquiry in their classrooms.

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The Eco-Inquiry MESA called "Buried Treasures," which is set in an urban neighborhood, concludes with a rap:

When you think about something that you
can't explain ...
When you got a problem and use your
brain ...
When you tried 'til you got what the
answer was,
Baby -- you're thinking like a scientist
*does!**

It is the goal of Institute educators that by the year 2000 many, many more students across the United States will be thinking critically and creatively, as scientists do.

* *by Douglas Anderson, for Monadnock Media, Inc.*

Spring Calendar

CONTINUING EDUCATION PROGRAM

Among the **spring semester**'s offerings are some special one-day programs as well as one- and two-day ecological excursions:

Apr. 4: Workshop: **Designing the Naturalistic Garden**
Apr. 30: Field Course: **Planting and Transplanting Trees and Shrubs**
May 5: Excursion: **Ethnobotany and American Indian Heritage**
May 9: Excursion: **Ecology and Earth History: Catskills and Hudson Valley Lowlands**
May 16 & 17: Excursion: **Whale Watch and Plimoth Plantation**
May 27: Excursion: **Garden in the Woods**
June 13: Excursion: **Ecology and Earth History: The Hudson Highlands**
June 20 & 21: Excursion: **Summer Gardens Tour: Longwood Gardens and Winterthur Museum and Gardens**
June 27: Field Course: **Ferns of the Northeast**

• *Catalogues describing all the spring classes, workshops and excursions are available at the Gifford House.*

SUNDAY ECOLOGY PROGRAMS

Free public programs are held on the first and third Sunday of each month, except over holiday weekends. Programs begin at 2 p.m. at the Gifford House on Route 44A unless otherwise noted. Call (914) 677-5359 to confirm the day's topic.

Apr. 5: **Which Came First: the Flower? ... or the Pollen?**, a slide presentation by Dr. Steward Pickett.
May 3: **Winter and Spring Clues for Tree Identification**, a walk led by Dr. Alan Berkowitz.
May 17: **How Plants Defend Themsleves**, a walk led by Dr. Clive Jones.

Sunday Programs, continued

June 7: **The Shape of the Land: Traces of the Past**, a walk led by Erik Lilleskov.
June 21: to be announced

• *For outdoor programs, long pants, socks and sturdy waterproof shoes are strongly suggested. In case of inclement weather, call (914) 677-5358 after 1 p.m. to learn the status of the day's program.*

IES SEMINARS

The Institute's program of **scientific seminars** features presentations by visiting scientists. Free seminars are held at the Plant Science Building on Fridays at 3:30 p.m.

Mar. 27: **Impact of Acidification on Zooplankton in Ontario Lakes**, by Dr. Norman Yan, Ontario Ministry of the Environment.
Apr. 3: Topic: **Molecular genetics and systematics**, by Dr. Diana Lipscomb, Georgetown University.
Apr. 10: Topic: **Insect host-parasite relationship**, by Dr. Nancy Beckage, University of California at Riverside.
Apr. 24: **Marine Plant-Herbivore Interactions: An Interhemispheric Comparison**, by Dr. James A. Estes, University of California at Santa Cruz.
May 1: **Questions of Scientific Responsibility**, by Dr. Serge Lang, Yale University.
May 8: **Nitrogen Dynamics in Agricultural Landscapes: Local Processes, Regional Effects**, by Dr. G. Philip Robertson, Michigan State University.
May 15: **Teaching 5th Graders About Ecosystems: A Conceptual Change Approach**, by Dr. Kathleen Roth, Michigan State University.

• *Call (914) 677-5343 to confirm the day's seminar topic.*

GREENHOUSE

The IES greenhouse is a year-round tropical plant paradise as well as a site for controlled environmental research. The greenhouse is open during Arboretum hours. Admission is by free permit from the Gifford House.

GIFT SHOP

Senior Citizens Days: On Wednesdays senior citizens receive a 10% discount on all purchases (except sale items).
April - May: Divisions from the IES Perennial Garden will be available in the Plant Shop.
May 29 - 30: Annual Plant Sale -- all perennials discounted 10%, with 20% off for members.

ARBORETUM HOURS
(Winter hours: October 1 - April 30; closed on public holidays)

Arboretum grounds are open Mon. - Sat., 9 a.m. to 4 p.m.; Sun. 1 - 4 p.m. Internal roads and trails are closed when snow- or ice-covered. The **Gift and Plant Shop** is open Tues. - Sat., 11 a.m. to 4 p.m. and Sun. 1 - 4 p.m. (closed weekdays from 1 - 1:30 p.m.).

• *All visitors must obtain a free permit at the Gifford House for access to the Arboretum. Permits are available until 3:00 p.m. daily.*

MEMBERSHIP

Become a member of the Mary Flagler Cary Arboretum. Benefits include a member's rate for IES courses and excursions, a 10% discount on purchases from the Gift Shop, a free subscription to the IES NEWSLETTER, and parking privileges and free admission to the Enid A. Haupt Conservatory at The New York Botanical Garden in the Bronx. Individual membership is $30; family membership is $40. For information on memberships, contact Janice Claiborne at (914) 677-5343.

For more information, call (914) 677-5359 weekdays from 8:30 - 4:30.

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